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Gender of gender studies: examining regional and gender-based disparities in scholarly publications

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Abstract
This study comprehensively analyses gender representation and citation disparities in gender studies by examining the position of female scholars as first and corresponding authors. The research uncovers a pattern of gender-homogeneous co-authorship and investigates the geographical and economic disparities in academic contributions, scrutinising the impact of a country's economic status on citation rates and open-access publications, particularly in relation to citation rates and open-access publications. The study uses a Logistics Regression and Zero-Inflated Negative Binomial Regression model to explore factors influencing open-access publication and citation rates. The study's findings demonstrate the predominant presence of female scholars in gender-focused literature within social sciences, in contrast to their underrepresentation in STEM fields. The findings also reveal a tendency towards gender-homogenous collaborations and a significant concentration of scholarly output from the high-income regions, highlighting both geographic and economic disparities. The present study provides an analytical foundation for future studies on the global distribution of scholarly contributions and the complex interplay of various factors affecting academic publishing in gender studies.

Keywords Gender studies · Bibliometric · Gender disparity · Regional disparity · Open access

JEL Classification J16 · I23 · B54 · P48

Introduction

Exploring gender dynamics in social sciences has transcended academic frontiers, becoming a pivot of societal discourse. This study aims to carefully examine how gender and geographic factors intersect within academic literature. The emergence of gender studies as a distinct and pivotal academic sphere echoes a broader societal transformation, emphasising the fluidity and complexity of gender as a concept. This

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transformation is not confined to academic circles but resonates throughout the fabric of global communities, necessitating a holistic examination of gender in social sciences.

The study of gender dynamics within the social sciences represents a significant paradigm shift from the traditional focus observed in STEM (Science, technology, engineering, and mathematics) fields. This shift highlights the intricate nature of gender roles and their profound impact on societal structures and interactions. As articulated by Brown and Moorer (2015), gender studies have evolved into an interdisciplinary domain, embodying diverse perspectives on gender and its societal ramifications. Integrating gender studies across various disciplines underscores the urgency for a comprehensive understanding of gender in different social and academic contexts.

Our research builds on the premise that gender is pivotal in the social sciences landscape. Despite the progress highlighted in existing literature (Jamali & Abbasi, 2023), challenges such as gender disparities in academic publishing (Joanis & Patil, 2022; Meho, 2022) and the influence of regional factors on scholarly activities remain persistent concerns (Froehlich et al., 2022; Nakajima et al., 2023). Our study aims to contribute to the existing body of knowledge by exploring the interplay between gender and geographical region in social sciences research, with a particular focus on gender studies.

A review of previous literature reveals a notable gap: studies exploring gender representation within scholarly output and the presence of regional and economic disparities are limited, particularly within the context of gender studies. This gap is not just an academic oversight but reflects broader societal trends. Understanding this intersection is crucial in an era marked by increasing globalisation and cultural exchanges. Therefore, our research addresses the regional aspects of gender studies in social sciences and the representation and treatment of gender within gender-focused academic literature (Ajay et al., 2024; Dong & Li, 2023; Jamali & Abbasi, 2023; Pilkina & Lovakov, 2022; Radina et al., 2022; Shang et al., 2022).

This study specifically investigates the representation of female scholars in gender-focused literature, assessing their roles as primary and corresponding authors, and explores the citation gap between male and female first authors to identify potential systemic biases. It also examines collaborative patterns, including gender-homogeneous co-authorship. It evaluates geographical disparities in scholarly contributions, considering the economic status of countries and their influence on citation rates and open-access publication likelihood.

Our approach classifies 150 countries by geographical region and income status. This classification facilitates an analysis of disparities in scholarly contributions and recognition in gender studies globally. We use zero-inflated negative binomial regression to identify factors impacting citation rates and logistic regression to examine factors influencing open-access publications. This methodology sheds light on the influence of geographical and economic factors with gender issues in social sciences, revealing previously underexplored nuances.

The study's findings indicate a notable presence of female scholars in gender-focused social sciences, contrasting their underrepresentation in STEM fields. However, this presence is accompanied by citation gaps and gender-based collaboration trends, suggesting enduring academic biases. Additionally, there is a notable regional imbalance in scholarly outputs, favouring more affluent regions.

The structure of this paper is as follows: This introduction sets the stage for our investigation. Subsequent sections detail our methodology, including data and variable descriptions. The results section presents an analysis of the impact of gender and region on gender studies in social sciences research, followed by discussions that contextualise these

findings within the broader academic sphere. The conclusion encapsulates our findings and discusses their implications for the future of gender studies in social sciences.

Literature review

The issue of gender disparity in academic publishing is a significant concern that has been studied extensively in bibliometric literature (Halevi, 2019). Radina et al. (2022) highlight the influence of gender stereotypes and social norms on scientific activity and publication patterns. Often established in educational settings, these stereotypes influence researchers' involvement in scientific domains, impacting their publication outputs and visibility in academia. Abramo et al. (2009) and Pilkina and Lovakov (2022) investigated the research productivity within the Italian and Russian academia, respectively and found significant gender disparity, particularly in scientific-technological disciplines. However, the studies also noted a decreasing gender productivity gap over time. This trend of narrowing gender disparity has been mirrored in certain areas, suggesting a significant shift in the gender dynamics of academia (Van den Asserson & Janis, 2022; Besselaar & Sandström, 2016). Nonetheless, the underrepresentation of women, particularly in senior roles, remains a widespread concern in various fields, including political science (Teele & Thelen, 2017), social psychology (Formanowicz et al., 2023) and surgical literature (Ajay et al., 2024), indicating a need to address gender biases in academic visibility and authorship.

West et al. (2013) found men predominating in prestigious authorship roles while women were underrepresented in single-authored papers. The study by Holman et al. (2018) further highlights the gender gap in authorship positions across STEM fields, with the underrepresentation of women in senior authorship positions. This is complemented by Ley and Hamilton (2008), Shen (2013) and Lincoln et al. (2012), underscoring the progress and challenges in achieving gender equity, from admissions to medical schools to distribution of prestigious awards. The "glass ceiling" effect in scientific research was studied by de Cheveigné (2009), indicating potential bias in evaluation criteria that hinders women's career advancement. Beaudry et al. (2023), addressing the gender disparities in African scientific publications, found that age and collaboration positively impact women's research output while household chores and care duties impede them. Women are as prolific as men and obtain the same amount of research funding when they devote the same hours to academia. However, through a mixed approach method, Fox et al. (2017) revealed systematic barriers such as gender bias and discrimination in STEM fields. They advocated for greater mentorship and support networks for females in promoting gender equity in the scientific workplace.

Gender homophily in research

Gender homophily in academic authorship, a tendency for researchers to collaborate with same-gender peers, leads to single-gender author teams and reduces mixed-gender collaborations. This pattern limits perspective diversity and potential innovation in research, especially in fields with gender imbalances, exacerbating disparities in contributions and recognition (Holman & Morandin, 2019; Prihatini & Prajuli, 2022). Women-led studies in ice core science found 20% more women co-authors than men-led studies, indicating gender homophily. The presence of more women co-authors in women-led studies is expected to lead to a more collaborative, supportive, and diverse research environment (Koffman et al., 2023). In contrast,

male scientists in Poland were found to collaborate with other male scientists, indicating gender homophily (Kwiek & Roszka, 2021). In open-access publishing, gender-diverse teams are more likely to publish, whereas single-gender teams, particularly all-female ones, are less inclined to do so (Nguyen et al., 2021). The prevalence of gender homophily varies regionally, reflecting cultural, economic, and institutional differences, with distinct characteristics in non-Western countries (Prihatini & Prajuli, 2022).

Regional and economic disparities

The influence of regional and economic factors on scholarly publications in gender studies is significant. Wood (2015) emphasizes how the local environment within academic departments shapes the development and focus of gender research. This results in diverse interpretations and redefinitions of key concepts in gender studies, reflecting the varied institutional and intellectual contexts across different regions. Such diversity highlights the necessity for gender studies to adopt a globally inclusive perspective.

Notably, as Bentley (2015) points out, there are marked cross-country differences in the productivity of individual scholars in publishing. These disparities are influenced by various factors, including the primary language of the researchers and their propensity to publish in diverse types of journals. El-Ouahi & Lariviere (2023) investigated gender disparity in scientific research for the Middle East and North Africa (MENA) region, highlighting significant challenges in achieving gender parity. Male authors enjoy higher research productivity, representation, and seniority than women, though the differences and progress are markedly different among the different countries in the region. Additionally, Man et al. (2004) highlights the relationship between research funding and English proficiency on publication output, particularly in developed countries, underlining the impact of economic and linguistic factors on academic publishing.

Gender and collaboration patterns in academia

The role of gender in shaping collaboration patterns in academia has been extensively studied. Gender shapes the patterns of international collaborations, with women being less likely to engage in such collaborations than men (Fox, 2020). Williams et al. (2016) investigate how gender biases affect women's participation in scientific fields, especially in STEM. These biases manifest in different ways, including the patterns of employment and mentorship in academic labs and the representation of women in scientific research teams. Larivière et al. (2011), investigating gender disparity in research funding and productivity in Quebec universities, found that male professors received more research funding and publications than their female counterparts. Jamali and Abbasi (2023) reveal that gender significantly influences the ability to acquire critical positions within AI scientific collaboration networks, with women often facing challenges in securing central roles due to systemic gender biases. Studying the collaboration patterns, Larivière et al. (2013) and Paul-Hus et al. (2014) found that women are more engaged in domestic collaboration while men are active in international collaborations.

Citation practices and gender biases

Citation practices and gender biases in academic publishing are areas of critical concern. Annalingam et al. (2014) aimed to study the determinants of citations and found the

journal rank, number of authors, collaboration patterns, etc., as significant factors leading to higher citation rates. Craig et al. (2007) found that open-access publications may not necessarily lead to higher citation rates. Nadeem (2019) examines how gender affects the citation and recognition of scholarly work, uncovering an inherent bias in how academic work is acknowledged based on the author's gender. Huang et al. (2020), in their empirical analysis, established a systematic gender disparity, with male scientist receiving 30% more citations than their female counterparts. Larivière et al. (2013) and Maddi and Gingras (2021) find that publications led by women receive fewer citations, partly attributed to lower rates of international collaboration among women**.** Zhang et al. (2021) found that male researchers achieve higher citation rates since they focus on scientific progress while female researchers prioritise on societal progress. This trend, however, varies across different countries and disciplines. In a contrasting observation, Jamali and Abbasi (2023) and Thelwall (2020) note that female scholars in specific disciplines enjoy a citation advantage, as evidenced by a higher average citation rate for articles with female first authors.

Role of first author and corresponding author

In the context of academic publications, the position of authorship roles- particularly those of first author and last author- holds significant importance as they signal the nature and extent of academic contribution (Helgesson & Eriksson, 2018). The first author is typically regarded as the primary contributor who leads the manuscript's development, design, implementation and writing, indicating the most prestigious position among the authors (Sundling, 2023). This position is considered pivotal as it represents the individual who put the most effort into the project (Tscharntke et al., 2007). Further, the corresponding author is entrusted with the crucial role of communication, not only during the submission stage but also post-publication, acting as the main point of contact for enquiries, clarifications, and collaboration related to the study (Helgesson, 2021; Mattsson et al., 2011; Weiss, 2012). The role of the corresponding author is crucial for upholding the accessibility and integrity of research (McNutt et al., 2018) and is perceived to confer seniority (Vanz et al., 2023). This role becomes particularly significant when the first author assumes the corresponding authorship (Bhandari et al., 2004). While the last author's position indicates seniority or supervision (Sundling, 2023), the significance of the position may vary and does not necessarily imply being the primary contributor or supervisor (Tscharntke et al., 2007).

Core-periphery issue in academia

The core-periphery dynamics in academia, amplified by its widespread usage of English, expose deep-rooted inequities in knowledge creation and academic cooperation. The unequal distribution of academic visibility and influence is highlighted by the prominence of research output from North America and Europe (Mosbah-Natanson & Gingers, 2014; Chinchilla-Rodríguez et al. (2019). According to Wagner et al. (2001), international partnerships are crucial in reducing these discrepancies and enhancing research capacity across diverse regions. The semi-peripheral regions are particularly affected, as they find themselves caught between local academic traditions and dominant academic standards dominated by English, impacting their capacity to publish in high-impact factor journals and achieving global recognition (Arnbjörnsdóttir & Ingvarsdóttir, 2017; Bennett, 2014). The challenge goes beyond language proficiency to include developing a compelling academic style and adhering to rhetoric conventions in English-language academic discourse,

a significant barrier for scholars from non-core regions (Flowerdew, 1999, 2000, 2001, 2015; Lillis & Curry, 2006, 2010). Further, the academic contributions from these regions face the risk of being marginalised, viewed as national illustrations rather than theoretical advances, perpetuating inequalities within the academic field (Bennet, 2014).

In conclusion, the literature review presents a multifaceted picture of the impact of gender and region on research publications. Despite the dynamic evolution of gender studies, gender disparities in academic publishing, influenced by stereotypes and social norms, remain a significant concern. The need for a more inclusive approach and equitable citation practices in gender studies is evident.

Methodology

Data and variable description

The dataset for the present study was extracted from the Web of Science Core Collection on January 12, 2024, encompassing 68,587 publications after the removal of duplicate values.[1] The study focuses on social science literature with an emphasis on studies on gender. The dataset included publication from the inception of database until the date of extraction, allowing for a longitudinal analysis of trends in the research area. Refining the data, a search query was employed with specific keywords related to gender, such as "women," "gender," "female," "male," "feminism," "feminist," "sexual orientation," "sex roles," "transgender," "transsexual," "matriarchy," "patriarchy," "marital roles," and "LGBT" in the title and author keywords.[2] Selection criteria were kept stringent, limited to records within the Social Sciences Citation Index (SSCI), and confined to research areas related to social sciences. The advanced search query used is provided in the footnotes.[3]

In the study, while the gender of each author was specified, the full counting approach primarily focused on the gender of the first author. This method attributes the entire publication to the first author's gender, considering the prevalent academic convention that views the first author as the primary contributor. As the gender of the authors was not explicitly provided, it was inferred using a machine learning-based application, Gender API, applying an 80% confidence threshold and focusing on names with at least 10 occurrences in the application database to ensure data reliability. The authors arrived at the threshold limit based on trial and error to minimise incorrect gender assignments. To

[1] Due to the limitation of downloading only 1000 records per session, multiple download sessions were necessary to gather the complete dataset.

[2] Abstracts were not included in our data collection, as our focus was specifically on gender-related studies, and including abstracts would have brought in non-relevant, non-gender-focused research.

[3] The advanced search query used was: TI = ("women" OR "gender" OR "female" OR "male" OR "feminism" OR "feminist" OR "sexual orientation" OR "sex roles" OR "transgender" OR "transsexual" OR "matriarchy" OR "patriarchy" OR "marital roles" OR "lgbt") OR AK = ("women" OR "gender" OR "female" OR "male" OR "feminism" OR "feminist" OR "sexual orientation" OR "sex roles" OR "transgender" OR "transsexual" OR "matriarchy" OR "patriarchy" OR "marital roles" OR "lgbt") refined to Subject Areas = ("Psychology" OR "Women Studies" OR "Business Economics" OR "Social Sciences Other Topics" OR "Sociology" OR "Family Studies" OR "Social Work" OR "International Relations" OR "Public Administration" OR "Ethnic Studies" OR "History" OR "Social Issues" OR "Demography" OR "Development Studies" OR "Area Studies" OR "Cultural Studies"OR "Geography" OR "Religion" OR "Philosophy" OR "Asian Studies" OR "Urban Studies"), Document Type- "Article", Languages- "English" and Web of Science Index- "Social Sciences Citation Index (SSCI)".

partially address the regional differences, we utilised the country column from our data to account for the differences in various regions regarding naming conventions. The exclusion of names below our confidence threshold culminated in a final sample of 55,145 publications with predicted gender, potentially limiting our analysis towards more easily recognisable names. The analysis was restricted to the first 50 authors for each paper, noting that only 18 papers exceeded this author count.

The country of the corresponding author is deduced from the "Reprint Address" column of publication records, which provides the address of the corresponding author. Due to the absence of detailed country information for all the authors, the study employs a full counting method. Accordingly, the country of the corresponding author was solely used to represent the geographical attribution of each publication. The countries were further categorised based on the geographical region and income levels following the World Bank's classifications.[4] Based on Income levels, the countries were classified as High-Income, Upper-Middle-Income, Lower-Middle-Income, and Low-Income Economies. The classifications based on geographical location resulted in regions of East Asia and Pacific, Europe and Central Asia, Latin America and Caribbean, Middle East and North Africa, North America, South Asia, and Sub-Saharan Africa. A total of 67,922 entries had these two categories made.

For the classification of publications as Open Access, the "Open Access Designations" column available in Web of Science Core Collection dataset was utilised. This column lists the various types of open-access options opted for by each paper, including hybrid, Green Published, Green Submitted, Gold, Bronze and Green Accepted. Any publication with any of these designations was categorised as "Open Access", while the publications without any designations were categorised as "Non-Open Access".

Methods

The study employs various statistical tools to elucidate relationships and patterns within our data. The Chi-squared (χ^2) test assessed the independence of categorical variables, such as gender and region, and their association with multiple publication metrics. For the continuous variables, the t-test for unequal variances was used to compare the mean values of different groups, such as the average citation counts, the number of co-authors, etc.

Wilcoxon rank-sum (Man-Whitney)

A two-sample Wilcoxon rank-sum (Man-Whitney) test was performed to assess whether statistical differences exist in the ranks of two independent samples. Specifically, in the current study, this test is used to analyse if the counts of female co-authors on a paper with female first authors are statistically significant from those with male first authors. The rank sum column shows the sum of ranks for the female co-author count within each group, while the expected column gives the mean rank that each group has if there are no differences between the groups. The test statistic measures the differences between the ranks of the two groups, and a higher value for the first group indicates that its ranks are higher than expected under the null hypothesis.

[4] For detailed information and the specific classifications, you can visit the World Bank's classification page.

The Wilcoxon rank-sum test was conducted using the following formulas:

For each group, labelled as female first authors and male first authors, the rank sum W was calculated as:

$$W = \sum_{i=1}^{n} R_i \tag{1}$$

where R_i denotes the rank of each observation within the group and n represents the total number of observations in that group.

The expected rank sum under the null hypothesis, which posits no difference between the groups, was determined by the formula:

$$E(W) = \frac{n_1(n_1+n_2+1)}{2}$$

where n_1 is the number of observations in the first group n_2 is the number of observations in the second group.

The Mann–Whitney U statistic for each group was then obtained from the rank sum with the equation:

$$U = n_1 n_2 + \frac{n_1(n_1+n_2+1)}{2} - W$$

In this equation, n_1 is the number of observations in the group of interest, n_2 is the number of observations in the comparison group, and W is the rank sum of the interest group.

The test statistic used to determine the significance of the rank differences between the groups is the smaller of the two U values calculated for both groups.

Logistics regression

A logistics regression is employed to determine the factors impacting the choice of open access. Since the dependent variable is binary (whether the article has opted for open access), such a model is suited. In logistic regression, the coefficient of an odds ratio represents the change in the odds of the outcome occurring for a one-unit increase in the predictor variable. If an odds ratio is greater than 1, it signifies that an increase in the predictor variable is associated with higher odds of the outcome occurring. For instance, an odds ratio of 1.5 for a specific variable would mean that a one-unit increase in that variable is associated with a 50% increase in the odds of the outcome happening. Conversely, an odds ratio of less than 1 indicates that an increase in the predictor variable is associated with lower odds of the outcome. The equation can be represented as:

$$Log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots\cdots + \beta_n X_n \tag{2}$$

where p is the probability of an article being open access. $\frac{p}{1-p}$ is the odds ratio of the article being open access versus not. β_0 is the intercept term. $\beta_1, \beta_2, \ldots, \beta_n$ are the coefficients of

the predictor variables $X_1, X_2, \ldots, X_1$ which could include gender of the first author, geographic region, etc.

Zero-inflated negative binomial regression

Further, the study is interested in finding the various factors determining publication citation counts. However, given the count nature of citation data and the potential over-dispersion, in a case where the variance is larger than the mean, we applied Zero-Inflated Negative Binomial Regression (ZINBR). This model is particularly apt while dealing with data with excess zeros, as it simultaneously models the count data with a negative binomial distribution and the excess zeros with a logit model. In our sample, 7229 papers had no citations, thus justifying this approach. We included the income range of countries and dummy variables indicating open access as the predictor variables in the "inflate" part of the model. These are identified as factors that may influence the likelihood of a paper receiving no citation. The significance of these predictors is determined by their *p*-values, indicating whether their inclusion in the model is justified.

The count model can be represented as:

$$Log(\mu_i) = \alpha + \gamma_1 Z_1 + \gamma_2 Z_2 + \cdots \cdots + \gamma_m Z_m \tag{3}$$

The logit model for excess zeros is represented as:

$$Log\left(\frac{\pi_i}{1-\pi_i}\right) = \delta + \varnothing_1 W_1 + \varnothing_2 W_2 + \cdots \cdots + \varnothing_k W_k \tag{4}$$

where μ_i is the expected count of citations for the i-th article. π_i is the probability of the i-th article belonging to the excess zero group. α, δ are the intercepts for the count and zero-inflation parts, respectively. $\gamma_1, \gamma_2, \ldots, \gamma_m$ are the coefficients for predictors $Z_1, Z_2, \ldots, Z_m$ in the count model (e.g., income range of countries, number of authors). $\varnothing_1, \varnothing_2, \ldots, \varnothing_k$ are the coefficients for predictors $W_1, W_2, .., W_k$ in the zero-inflation model (e.g., indicators for open access). $Z_1, Z_2, \ldots, Z_m$ and $W_1, W_2, .., W_k$ are the predictor variables for the count and zero-inflation parts, respectively.

Results

Table 1 provides the descriptive statistics of the variables under study. Females predominantly hold first authorship, accounting for 67.82% of total publications. This indicates heightened female engagement in gender studies. However, a notable concentration of these studies (87.13%) originates from high-income countries. While the upper-middle-income country constituted 8.94%, the lower-middle-income and low-income countries shared a negligible 3.72% and 0.21% of all publications. Regarding geographical distribution, North America dominated the research landscape, contributing 45.01% of all studies. The United States, in particular, accounts for 39.75% of global publications.

Table 1 Descriptive statistics

Variable	Frequency (Count)	Mean	Percentage (%)
Discrete variables			
Gender of 1st author			
Male	17,745		32.18
Female	37,400		67.82
Corresponding author's country by income range			
High income	59,145		87.13
Upper middle income	6068		8.94
Lower middle income	2528		3.72
Low income	141		0.21
Region of corresponding author's country			
East Asia and Pacific	8756		12.90
Europe and Central Asia	22,328		32.89
Latin America and Caribbean	1647		2.43
Middle East and North Africa	2024		2.98
North America	30,552		45.01
South Asia	1200		1.77
Sub-Saharan Africa	1376		2.03
Open access			
Yes	26,996		39.36
No	41,591		60.64
Continuous variables			
Average times cited in web of science		15.19	
Average times cited in all databases		17.996	
Average number of authors per publication		3.31	

For discrete variables, 'Frequency (Count)' represents the number of publications within each category, and 'Percentage' shows the proportion of the total count. For continuous variables, 'Mean' shows the average value across all publications within the dataset

Europe and Central Asia closely follow with 32.89% of total output. In contrast, regions such as South Asia contributed minimally, with 1.77%, reflecting broader disparities in global academic contributions. Most publications in our sample (60.64%) do not adhere to open-access policies. The table indicates that, on average, each publication had 3.31 authors and received 17.99 citations across all databases.[5]

Investigating gender dynamics, the study found that women are more likely to be corresponding authors compared to men when they are first authors, suggesting a potential disparity in academic leadership roles (Table 2, Fig. 1). Studying the collaborative patterns, Table 3 highlights a tendency for female researchers to co-author with other women, averaging 1.29 female collaborators, as opposed to 0.912 when a male author is first author. However, those publications with a male as the first author tend to have more co-authors, as indicated by Table 4. These patterns may reflect gendered networks or biases in academic collaborations.

[5] The mean citation in web of science data base was 15.19.

Table 2 Gender of corresponding author and first author

First author gender	The corresponding author is the first author		Total
	No	Yes	
Female	6263 (16.82%)	30,971 (83.18)	37,234 (100)
Male	3315 (18.65%)	14,360 (81.25)	17,684 (100)
Total	9578	45,340	54,918
Chi 2 (1)	30.8596	Pr 0.000	

Figure in () shows the row percentage

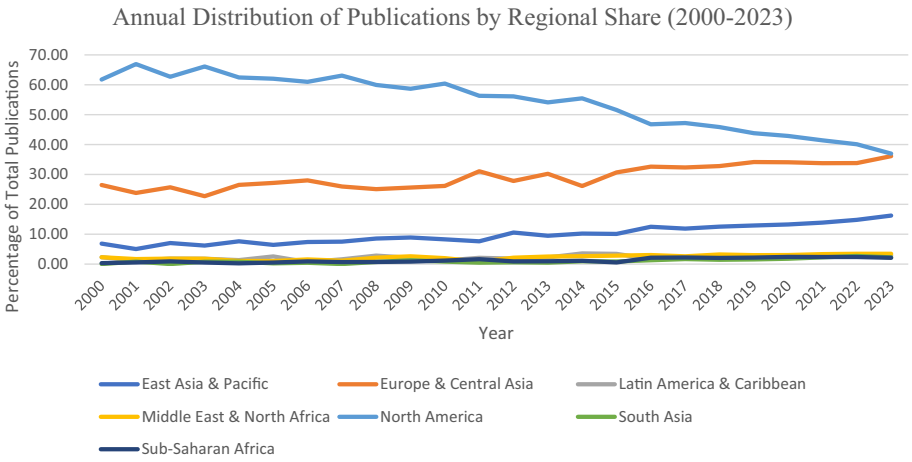

Fig. 1 Regional distribution of publications (2000–2023)

Table 3 Relationship between gender of first author and collaboration with female coauthors- two sample Wilcoxon rank sum (Mann Whitney) test

Gender of first author	Female first author	Male first author	Total
Average number of female coauthors	**1.297**	**0.912**	1.173488
Observations	37,400	17,745	55,145
Rank sum	1.081e + 09	4.394e + 08	1.521e + 09
Expected rank sum	1.031e + 09	1.521e + 09	1.521e + 09
Unadjusted variance			− 3.130e + 11
Adjustment for ties			− 3.130e + 11
Adjusted variance			2.737e + 12
Wilcoxon rank-sum test statistic			z = 30.173
P-value			< 0.0001

Table 4 Gender of first author and number of coauthors

Gender	Number of coauthors	Standard dev	Obs
Female	3.240	2.839	37,400
Male	3.336	2.594	17,745
Total	3.271	2.763	55,145
Diff	− 0.0959		
t-3.9328	P-value 0.0001		

Table 5 Gender of first author and open access

Gender of the first author	No open access	Open access	Total
Female	21,570 (57.67)	15,830 (42.33)	37,400 (100.00)
Male	10,680 (60.19)	7,065 (39.81)	17,745 (100.00)
Total	32,250 (58.48)	22,895 (41.52)	55,145 (100.00)
Pearson chi2(1) 35.7321		Pr 0.000	

() represents row percentage

Table 6 Citation count by gender

Gender of first author	Web of science		All databases		Obs
	Mean citation	Std dev	Mean citation	Std dev	
Female	12.777	26.713	15.253	32.509	37,400
Male	15.761	31.368	18.424	37.192	17,745
Combined	13.737	28.329	16.273	34.192	55,145
t-value − 10.929			*t*-value − 9.728		
p-value 0.000			*p*-value 0.000		

The open access trends suggest that female first authors are more likely to adopt them (Table 5). While 42.33% of female first-authored papers have open access, only 39.8% of the papers with male first authors have open access. Despite this, male first-authored papers achieve higher citation counts, with 18.42 in all the databases (15.76 in Web of Sciences), compared to females with only 15.25 (12.177 in Web of Science). These findings warrant further investigation into the factors influencing citation practices (Table 6).

The study's findings delineate a clear divergence in the frequency of women's publications across various world regions. Table 7 illustrates a higher likelihood of women publishing in affluent areas- women account for approximately two-thirds of all publications in both North America and regions of Europe and Central Asia. In contrast, publications from women in less developed areas like Sub-Saharan Africa and South Asia are significantly lower, highlighting a disparity in scholarly contributions to gender studies based on regional development. Furthermore, the data underscores the predominance of high-income countries in scholarly output, contributing over 89% of total publications, as evidenced by Table 8 and Fig. 2.

Table 7 Relationship between gender and region of corresponding author

Region	Gender of corresponding author		
	Female	Male	Total
East Asia and Pacific	3263 (59.53) [9.03]	2218 (40.47) [11.72]	5481 (100.00) [9.95]
Europe and Central Asia	12,906 (66.56) [35.72]	6483 (33.44) [34.25]	19,389 (100.00) [35.22]
Latin America and Caribbean	901 (60.80) [2.49]	581 (39.20) [3.07]	1482 (100) [2.69]
Middle East and North Africa	937 (57.70) [2.59]	687 (42.30) [3.63]	1624 (100.00) [45.49]
North America	17,100 (68.27) [47.33]	7946 (31.71) [41.97]	25,046 (100.00) [45.49]
South Asia	497 (52.93) [1.38]	442 (47.07) [2.33]	939 (100.00) [1.71]
Sub-Saharan Africa	523 (47.68) [1.45]	574 (52.32) [3.03]	1097 (100.00) [1.99]
Total	36,127 (65.62) [100.00]	18,931 (34.38) [100.00]	55,058 (100.00) [100.00]
Pearson chi2(6) = 459.9572	Pr = 0.000		

() represents row percentage, [] represents column percentage

Table 8 Gender and income of country

Country income	Gender of first author		Total
	Female	Male	
High income	33,795 (69.26) [90.89]	15,002 (30.74) 85.40	48,797 (100.00) 89.13
Upper-middle income	2263 (59.15) [6.09]	1563 (40.85) [8.90]	3826 (100.00) [6.99]
Lower-middle income	1084 (53.88) [2.92]	928 (46.12) [5.28]	2012 (100.00) [3.67]
Low income	41 (35.96) [0.11]	73 (64.04) [0.42]	114 (100.00) [0.21]
Total	37,183 (100.00) [100.00]	17,566 (100.00) [100.00]	54,749 (100.00) [100.00]
Pearson chi2(3) 410.6147		Pr 0.000	

() represents row percentage, [] represents column percentage

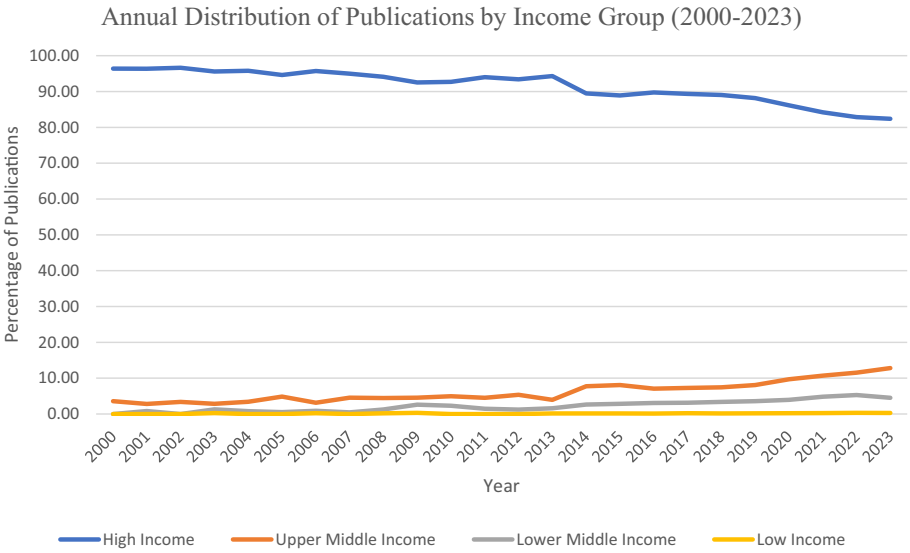

Fig. 2 Income-wise publication per year (2000–2023)

Table 9 Country wise classification of publications (top 90% restricted)

Country of corresponding author	Freq	Percent	Cumul
USA	26,738	39.37	39.37
England	5513	8.12	47.48
Canada	3815	5.62	53.10
Australia	3539	5.21	58.31
China	2505	3.69	62.00
Spain	2471	3.64	65.64
Germany	2373	3.49	69.13
Austria	1719	2.53	71.66
Netherlands	1370	2.02	73.68
Italy	1329	1.96	75.63
Sweden	1301	1.92	77.55
France	1260	1.86	79.40
Israel	1015	1.49	80.90
India	859	1.26	82.16
Turkey	810	1.19	83.36
South Korea	747	1.10	84.46
South Africa	735	1.08	85.54
Norway	670	0.99	86.52
Brazil	637	0.94	87.46
New Zealand	558	0.82	88.28
Switzerland	517	0.76	89.04
Finland	507	0.75	89.79
Japan	476	0.70	90.49

Table 10 Citation and income (high or non-high)

Region	Web of science		All databases		Obs
	Mean citation	Std dev	Mean citation	Std dev	
High income	16.057	33.773	19.124	41.259	59,145
Non-high income	8.566	18.936	9.488	21.646	8737
Combined	15.093	28.329	16.273		67,882
t-value 30.5056			*t*-value 33.5679		
p-value 0.000			*p*-value 0.000		

Table 11 Income classification and open access

Income classification	Open access		
	No	Yes	Total
High income	34,736 (58.73) [84.66]	24,409 (41.27) [90.90]	59,145 (100) [87.13]
Non-high income	6292 (72.02) [15.34]	2445 (27.98) [9.10]	8737 (100.00) [12.87]
Total	41,028 (60.44) [100.00]	26,854 (39.56) [100.00]	67,882 (100.00) [100.00]
Pearson chi2(1) 561.9403		Pr 0.000	

() represents row percentage, [] represents column percentage

A focused look at the individual country contributions reveals the United States as the primary source, contributing 39.37% of global publications, followed by England and Canada with 8.12% and 5.62%, respectively (Table 9). Table 10 reveals a concerning trend in the citation frequency, with publications from high-income countries averaging 19.12 citations in contrast to non-high-income countries with a significantly lower average of 9.48. This stark contrast suggests that the country's economic status may influence research's scholarly impact and reach. Additionally, Table 11 underscores a further inequality in academic dissemination: publications from non-high-income countries are less likely to be open access, with only 27.98% enjoying this status compared to 41.27% in high-income countries. This indicates a potential barrier to the free exchange of knowledge based on economic disparities (Fig. 3).

Table 12 presents a logistic regression analysis examining the determinants influencing the likelihood of an article being freely available under an open-access policy. The model indicates that if the first author is male, there is a statistically significant decrease in the odds of the article being open-access, as shown by an odds ratio of 0.91. In contrast, articles from high-income countries are substantially more likely to be open access, with the odds more than doubling (odds ratio of 2.23). The other coefficients represent the odds ratios for articles based on the geographical regions of the first author, with varying impacts on the likelihood of open access availability.

Table 13 presents the results of a zero-inflated negative binomial regression model for identifying the factors influencing citation rates. Male first authors are associated

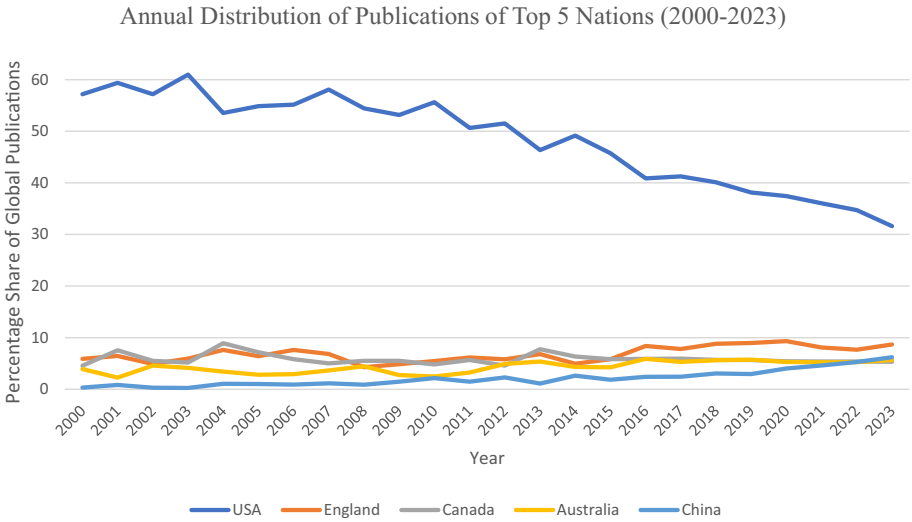

Fig. 3 National shares of global publications (2000–2023)

Table 12 Logistics regression-factors impacting open access

Open access	Odds ratio	Std. er	*z*	$p>z$
First author gender male	.9176235	.0180407	− 4.37	0.000
East Asia and the Pacific	.3957891	.0320027	− 11.46	0.000
Europe and Central Asia	1.153235	.0916349	1.79	0.073
Latin America and the Caribbean	.785215	.0674248	− 2.82	0.005
Middle East and Africa	.2868253	.0272031	− 13.17	0.000
North America	.3824208	.0308213	− 11.93	0.000
South Asia	.4917914	.0511572	− 6.82	0.000
High-income country	2.233294	.1038264	17.28	0.000
Number of pages	1.005274	.0012942	4.09	0.000
Language English	.4202907	.0353699	− 10.30	0.000
Number of authors	1.160574	.005005	34.53	0.000
_cons	.7929488	.0866889	− 2.12	0.034

with significantly higher citation rates than female first authors. Relative to the reference group of Sub-Saharan Africa, publications from geographical regions, notably North America, are linked to higher citations. For the income groups, "Low-income" countries serve as the reference category, and the study's findings indicate that high-income countries are more likely to be cited. Upper- and lower-middle-income countries do not have a significantly higher citation rate than the reference category. Open access status also positively impacts the citation rates significantly.

Table 13 Zero inflated negative binomial regression model- factors impacting citation

Times cited	Coefficient	Robust std. er	z	$p>z$
First_author_gender_male	.20774	.01829	11.35	0.000
East Asia and the Pacific	.11672	.07377	1.58	0.114
Europe and Central Asia	.04499	.07221	0.62	0.533
Latin America and the Caribbean	− .22807	.08698	− 2.62	0.009
Middle East and Africa	− .05919	.07496	− 0.79	0.430
North America	.40234	.07324	5.49	0.000
South Asia	.04766	.09865	0.48	0.629
Income group_high	.57046	.17744	3.21	0.001
Income group_ lower middle income	.21178	.17634	1.20	0.230
Income group upper middle income	.1299	.1757	0.74	0.460
Open access-yes	.10224	.01851	5.52	0.000
Number of pages	− .01053	.00244	− 4.31	0.000
First author is corresponding author	.08901	.02210	4.03	0.000
Number of authors	.05153	.00429	11.99	0.000
_cons	1.8202	.17140	10.62	0.000
Inflate				
Income group_high	− 34.086	2.3800	− 14.32	0.000
Income group_lower middle income	− 12.769	4.3401	− 2.94	0.003
Income group upper middle income	− 15.855	2.3897	− 6.63	0.000
Open access-yes	− 12.770	2.5308	− 5.05	0.000
_cons	− 3.366301	2.379608	− 1.41	0.157
/lnalpha	.5995682	.008096	74.06	0.000
alpha	1.821332	.0147455		1.79266

Further, the number of co-authors and pages of the article has a positive and significant impact on citations. The results further depict that in cases where the first author is also the corresponding author, the citations for the paper are higher than in cases when the first author is not the corresponding author. The model's inflation part, with significant coefficients for income groups and open access, suggests that these factors are relevant in predicting the excess zeros in total citation counts.

Discussion

The present study contributes to the existing bibliometric literature in the social sciences landscape, particularly those focusing on gender issues. Unlike STEM fields, where the narrative often centres around female underrepresentation (Fox et al., 2017; Frietsch et al., 2009; Ma et al., 2023; Penn et al., 2019; Phurtag et al., 2022), this research indicates a robust presence of female scholars in gender-focused literature. Notably, it is not just the prevalence of women as first authors that stands out but also their higher likelihood of being corresponding authors when they assume this leading role. This trend could reflect women's more outstanding agency over papers dealing with gender studies and a significant shift in academic dynamics similar to positive trends observed in Italy by Abramo

et al. (2009). However, this predominance brings to light several nuanced aspects within the academic field, including citation gaps and collaborative patterns.

A citation gap overshadows the participation of women in gender studies. Despite their inclination towards open-access publishing, female scholars receive fewer citations than their male counterparts. This suggests a systemic bias within the academic community, where work by women, even in fields addressing women's issues, is less recognized. This trend poses questions about the visibility and impact of female-led research in the broader academic discourse (Teele & Thelen, 2017). This citation gap observed in our study is reflected in the findings of Huang et al. (2020), showing male scientists receiving higher citation than female counterparts. Moreover, these observations align with the global analysis provided by Larivière et al. (2013), which reported that articles with women in dominant positions receive fewer citations than men in similar positions, underscoring widespread nature of these disparities. Further, this parallels the findings from El-Quahi & Lariviere (2023), which reports persistent gender disparity across various regions, that emphasize the universal nature of these challenges.

Our study uncovers a notable pattern in academic collaborations within gender studies, suggesting the presence of gender homophily. It appears that female scholars are less inclined to co-author with male counterparts. More frequently, research teams led by a female first author predominantly consist of female co-authors. This tendency towards same-gender collaboration exemplifies gender homophily, where individuals prefer to collaborate with others of their gender. The reasons behind this preference could be multifaceted, encompassing subconscious biases or a comfort factor in same-gender working groups. While such gender-homogenous collaboration may create a supportive network for women in academia (Ma et al., 2023; Penn et al., 2019), it also raises concerns about the potential limitations it places on diversity, impact, and interdisciplinary perspectives (Larivière et al., 2011; Nguyen et al., 2021).

There exists a geographical concentration of gender studies towards the wealthier regions, primarily North America and Europe, with a stark underrepresentation from lower-income countries. When examined through the core-periphery model in academia, this pattern suggests that disparities extend beyond mere resource limitations. Factors such as time lag in adopting new research items and the dominance of the English language in academic discourse may have contributed to these regional discrepancies (Lillis & Curry, 2006, 2010). The existence of these elements not only delays the engagement of peripheral countries with cutting-edge academic themes but also impacts their ability to publish high-impact journals and achieve global recognition. Additionally, the research contributions from these regions often face the risk of being marginalised, viewed primarily as local case studies rather than substantive theoretical contributions (Bennett, 2014; Chinchilla-Rodríguez et al., 2019; Mosbah-Natanson & Gingars, 2014). Such a skewed distribution not only limits the diversity of perspectives in gender research but also hinders the global understanding of gender issues. The lack of academic visibility and citation rates for the less developed geographical regions as evidenced by the study may also be viewed from the lens of core-periphery model.

The United States has historically been a dominant contributor to gender studies. However, it has witnessed a decline in its share of social science papers on gender issues, dropping from over 50% in the first decade of the millennium to around 31% in 2023. This change indicates a possible diversification in the geographical spread of gender research, although the USA still contributes a substantially high number of all the works in the area.

The research identifies a noteworthy that pattern although female authors are more likely to publish in open-access formats, this does not necessarily correlate with higher citations.

This observation points to a complex interaction between access to research and its academic impact (Craig et al., 2007). The likelihood of receiving a citation may be influenced by various factors, such as the choice of journals by female scholars and the average citation rate of the journals, which may not be directly linked to the open-access status of their publications (Annalingam et al., 2014). Thus, further analysis is required to fully understand the dynamics between open access and citation rates. The logistic regression analysis shows a significant association between female authorship and the choice of open-access publishing, indicating a female preference for open access. Furthermore, the study highlights a pronounced geographic imbalance in open-access publication, with authors from high-income countries considerably more likely to publish in this manner. This trend suggests that economic factors heavily influence publication strategies.

In addition, the study's application of a Zero-Inflated Negative Binomial Regression model sheds light on the multifaceted nature of citation rates. It reveals that factors such as the author's gender, geographic location, collaborative practices, and the open-access status of the publication play pivotal roles in determining the level of academic recognition a piece of work in gender studies receives.

These findings underscore the necessity of critically examining the current academic practices in gender studies. The discrepancies in citations, collaborative patterns, and geographical distribution call for a much-needed re-evaluation of the mechanisms that govern academic recognition and collaboration. Thus, efforts must be made to address these inequalities to foster a more inclusive, diverse, and globally representative academic environment in gender studies.

In conclusion, this study reveals the critical role played by female scholars in gender studies within social sciences but also uncovers the challenges they face in terms of recognition and collaboration. The geographical concentration of research in high-income countries and the disparities in citation and open-access publications highlight the need for systemic changes to achieve equity in academic research. This calls for concerted efforts from the academic community to address these disparities and promote a more inclusive and diverse field of gender studies.

Conclusion

The present study offers valuable insights into the domain of gender studies within the social sciences, foregrounding the pivotal roles played by female scholars and identifying the nuanced challenges they face in the academic landscape. Significantly, the research underscores the robust presence of female scholars in gender studies, a part of social sciences, which contrasts starkly with their underrepresentation in STEM fields (Fox et al., 2017; Holman et al., 2018). This finding is crucial as it shifts the narrative from a mere lack of women's participation to more complex academic recognition and impact issues. Despite their active engagement and leadership, as also noted by Paul-Hus et al. (2014), female scholars encounter a notable citation gap, indicating that the problems in gender studies extend beyond participation to include issues of visibility and impact. This gap is further exemplified by findings from Huang et al. (2020), which also showed that female scholars receive substantially lesser citations, suggesting significant hurdles in achieving recognition equivalent to male counterparts.

The study also highlights the significant geographical disparities in gender studies, with a concentration of research emanating from high-income regions, particularly North America and Europe. This imbalance, as supported by the core-periphery model (Bennet, 2014; Chinchilla- Rodríguez et al., 2019), points to issues in academia, affecting scholars from lower-income regions who grapple with challenges like limited resources, fewer publication opportunities, and reduced visibility. Moreover, the research highlights regional differences in citation rates and the likelihood of open-access publication. Studies from high-income countries are more cited and more likely to be open access, underlining a privileged academic position for these regions. Such regional imbalances hinder the diversity and global representation of perspectives in gender studies, making it imperative to address these inequalities for a more inclusive and representative academic field.

Despite these critical findings, it is essential to consider the limitations of our research. A primary limitation of the study stems from our reliance on the Gender API for inferring the gender of authors. While practical for analysing large datasets and commonly used in similar studies, this approach, based on name-based gender prediction, has some inherent limitations. The accuracy threshold of 80%, determined by the authors through trial and error, cannot guarantee absolute precision, particularly across different cultural contexts. Additionally, the reliance on names for gender prediction could not account for non-binary or gender fluid identities, overlooking the diversity of gender expressions.

Furthermore, the scope of this study is confined to the disciplines of social sciences, examining gender issues primarily within this domain. By not extending our analysis to fields like natural sciences, literature, or humanities, we limit our understanding of gender dynamics across the broader academic spectrum. This focus, while intentional, leaves room for further research into how gender issues manifest in other disciplines.

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Declarations

Competing interests There are no financial or non-financial conflicts between authors.

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